U.S. Appln. No. 09/473,547
Applicants: J. Benesty et al.
Reply to Office Action of May 25, 2005

Remarks

In view of the foregoing amendments and following remarks responsive to the Office Action dated May 25, 2005, Applicant respectfully requests favorable reconsideration of this application.

Non-Prior Art Rejections

In section 1 of the Office Action, the Office noted a typographical error in the fourth equation following equation 7. The Office's point is well taken and Applicant has herein amended the specification to correct the typographical error.

It is noted, however, that the Office's reference to page numbers of the specification of the present application appear to be off by two. For instance, section 1 of the Office Action refers to "The fourth equation following Equation 7 at page 22 of the specification...in accordance with the symbol convention stated at page 18, lines 13-17". However, in applicant's copy of the application, the equation appears on page 20, not page 22 and the symbol convention is disclosed on page 16, line 13-17, not page 18, lines 13-17. In any event , Applicant believes it has correctly interpreted the Office's intent in all instances throughout the Office Action.

In section 2 of the Office Action, the Office objected to claims 8-10 under 37 C.F.R. §1.75 as being a substantial duplicate of claims 3-5. The Office suggested that Applicant probably intended claims 8-10 to depend from claim 6, not claim 1. Once again, the Office's point is well taken. This is exactly what Applicant intended. Applicant has amended claims 8-10 accordingly.

In section 3 of the Office Action, the Office objected to claim 32 under 37 C.F.R. § 1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim. Once again, the Office has correctly detected a

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typographical error in the claims. Particularly, claim 32 should have depended from claim 28, not claim 30. Applicant has amended claim 32 accordingly.

In section 5 of the Office Action, the Office rejected claims 2, 7, 12, 19, 27, 34, 39 and 47 under 35 U.S.C. § 112, first paragraph, arguing that, while the specification is enabling for forming a circulant matrix by augmentation of a matrix of vectors representing an input signal, it does not reasonably provide enablement for forming a circulant matrix by augmenting the input signal in general (e.g. by adding another signal to the input signal or amplifying the input signal).

Applicant respectfully traverses. Even accepting the Office's assertions as to enablement, for sake of argument, "augmentation of a matrix of vectors representing an input signal" is a species of "augmentation of said input signal". Accordingly, claims 2, 7, 12, 19, 27, 34, 39, and 47 read on a species of the invention that the Office has expressly admitted is enabled by the specification. Nothing else is required. Accordingly, Applicant respectfully requests the Office to withdraw this rejection as it is improper.

Applicant is amendable to amending these claims to refer to augmentation of a representation of said input signal (which is what the "matrix of vectors representing an input signal" is), if this will satisfy the Office. However, Applicant notes that this amendment to the claim would either have no effect on the scope of the claim or would actually make the claim broader, not narrower.

In section 6 of the Office Action, the Office rejected claims 2, 3, 7, 8, 12, 13, 19, 20, 27, 28, 34, 35, 39, 40, 47, and 48 under 35 U.S.C. § 112, first paragraph, as being based on a disclosure that is not enabling. In short, the Office asserts that these claims recite only some of the steps that are "critical or essential to the practice of the invention". The Office asserts that "Applicants' have not disclosed an embodiment of the invention in which diagonally decomposing an augmented input matrix by Fourier

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transformation alone produces a usable estimate of the impulse response of an echo path".

Applicant respectfully traverses. Once again, it is believed that the Office is not properly interpreting the claims. If Applicant understands this rejection correctly, the Office has listed a series of steps that it claims are critical to the practice of the invention. It is unclear whether the Office obtained these steps from the present specification or from its own knowledge. In either event, however, the rejection does not have the makings of a proper non-enablement rejection. A non-enablement rejection essentially is a rejection based on a lack of teaching in the specification of what is claimed. Thus, the very fact that the Office asserts that it knows the steps that are "critical or essential to the practice of the invention" is evidence that the specification is, in fact, enabling. It does not matter whether the Office obtained that knowledge from the present specification or from the prior art. Nevertheless, it does appear that the Office found the allegedly critical or essential steps in the present specification.

This rejection might more properly have been characterized as a 35 U.S.C. § 112, second paragraph, rejection if, for instance, the claims did not recite sufficient steps to achieve the stated result (which appears to be what the Office is asserting), rather than the fact that the specification does not disclose sufficient structure or steps.

However, even if this is what the Office intended, the rejection still is improper because these claims do recite sufficient steps to achieve the stated result. They just recite them generically in the broader claims.

The very fact that the Office has not rejected the independent claims from which these claims depend indicates that the necessary steps are recited (admittedly in a very generic sense) in the claims. For instance, the specific steps listed by the Office are merely the details of the steps recited in the claims more generically. There is no

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obligation on Applicant to recite these steps specifically as long as there is language in the claim that generically reads on those steps.

By way of analogy, the Office's rejection is as if a claim recited building a table by cutting four 2X4's to create four legs, cutting a piece of plywood to create a table top, attaching the legs to the table top, and sanding the assembly. It would be improper for the Office to assert that the claim is non-enabling because it does not expressly recite how to attach the legs to the table top, e.g., nailing them together. Those steps are generically recited as attaching the legs to the table top. As long as the specification discloses the step of nailing them together, the claims are enabled by the specification. The claim would only be non-enabled only if the following two conditions were met: (a) a technique for attaching legs to a table top was not known in the prior art; and (b) the specification did not disclose a technique for attaching the legs to the table top.

It does not appear that the Office is asserting in the present case that the "critical or essential" steps that the Office has listed are not disclosed in the specification or are unknown in the prior art. In fact, such a scenario would be impossible because the Office would, therefore, not be able to list those steps if it did not know what they were.

Accordingly, Applicant respectfully requests the Office to withdraw this rejection.

In section 7 of the Office Action, the Office rejected claims 26 and 33 under 35 U.S.C. § 112, first paragraph, as based on a disclosure which is not enabling. The Office asserted:

> "subtracting said [echo signal] estimates from the signal transmitted over the [channel from said second location to said first location], critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. *Citation omitted.* The disclosure generally indicates that the echo/"impulse response" estimate must be subtracted form (sic) the transmitted signal in order to achieve distortion (echo) cancellation, and does not disclose an embodiment in which the desired result is achieved without execution of such a step".

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Applicant respectfully traverses for exactly the same reasons discussed above in connection with the rejection under section 6 of the Action. Particularly, the alleged problem is not an enablement issue. The Office is not asserting that the specification does not teach the allegedly necessary step. Rather, the Office is asserting that the specification does disclose the necessary steps, but that they are not recited in the claim. However, as before, the claim does not need to recite the steps specifically as long as it includes language that generically encompasses it. Clearly, these claims do include such language. Referring to Claim 26, for instance, the allegedly critical step of subtracting the echo signal estimates from the signal transmitted over the channel from the second location to the first location is merely a detailed description of the recited step of "developing an estimated impulse response corresponding to each of said multiple upstream channels that models an interference path at said second location from said corresponding upstream channel to said downstream channel". Thus, claim 26 does recite the allegedly critical step. It merely recites it in more general terminology than the specific embodiment discussed in the specification. This is standard claim drafting protocol. Clearly, the allegedly critical step is subsumed within the language of the above-quoted first paragraph of claim 26.

Accordingly, Applicant respectfully requests the Office to withdraw this rejection.

In section 9 of the Office Action, the Office rejected all of the claims, claims 1-52 under 35 U.S.C. § 112, second paragraph, as indefinite.

Applicant respectfully traverses.

In section 10 of the Office Action, the Office asserted that Applicant misused the term "impulse response" in claims 1-25, 38-42, 44, and 45 to mean "a signal or signal component", whereas Applicant correctly used the term "impulse response" in claims 26-37 to mean "the response of a system or network to a unit sample sequence", which the Office asserts is the accepted meaning of the term.

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The Office's point is well taken for the most part. Applicant has herein amended the claims to use the term "impulse response" consistently and in accordance with its accepted meaning. Applicant traverses only with respect to two aspects of this rejection. First, with respect to the Office's assertion that Applicant's use of the term "impulse response" in original claims 38-42, these claims already appear to be consistent with the acceptable meaning of the term and particularly appear to be consistent with the use in claims 26-37, and 43, which the Office already has indicated is acceptable. Second, contrary to section 10 of Office Action, the term "impulse response" does not appear in claims 44 and 45.

Also, Applicant notes that the Office did not mention claims 46-48, 51, and 52, which claims include the term "impulse response". Nevertheless, Applicant has reviewed those claims and the use of the term "impulse response" in those claims appears to be consistent with the use in acceptable claims 26-37, and 43, and in accordance with the accepted meaning of the term "impulse response".

Accordingly, in view of the aforementioned amendments, Applicant respectfully requests the Office to withdraw this rejection.

In section 11 of the Office Action, the Office rejected claims 1, 6, 11, 18, and 26 asserting that these claims use the singular and plural forms of the word "estimate" alternately and inconsistently (e.g., reciting and "estimate", and then later reciting "said estimates", "said individual estimates", and in some cases again later reciting "said estimate".)

The Office's point is well taken with respect to claims 18 and 26 and Applicant has amended these claims accordingly. However, claims 1, 6, and 11 are grammatically correct in their singular and plural use of the word "estimate".

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Specifically, with respect to claims 1, 6, and 11 (and using claim 1 as an example), these claims recite "generating an estimate of an impulse response corresponding to <u>each</u> of said <u>multiple</u> impulse responses". Accordingly, although the singular form of the word "estimate" is used in this step, the step quite clearly recites that there are multiple such estimates being generated. The next step is "generating a sum of said estimates". This step merely recites generating a sum of each of the individual estimates generated for "each of said multiple impulse responses". Accordingly, the language of these claims is perfectly appropriate and any changes would, if fact, make the language less appropriate.

With respect to claims 18 and 26, on the other hand, the Office's point is well taken. Applicant has, in fact, improperly used the singular and plural forms of the word "estimate". Hence, Applicant has amended those claims in order to eliminate these problems and make them consistent with the terminology as used in claims 1, 6, and 11.

In section 12 of the Office Action, the Office asked that various variables appearing in the claims be defined directly in the claims, rather than relying on the definitions set forth in the specification. Applicant has herein amended the claims accordingly.

In section 13 of the Office Action, the Office noted that, in claim 11, the limitation "an estimate of an impulse response corresponding to each of said first and second impulse responses" lacks antecedent basis. Applicant has herein amended claims 11 in order to eliminate this problem.

In section 14 of the Office Action, the Office pointed out that, in claims 26-28, and 33-35, the limitations "said multiple upstream channels" and "said downstream channel" lack antecedent basis. Applicant has herein corrected these claims to overcome this rejection.

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In section 15 of the Office Action, the Office indicated that, in claim 33, uses of the singular and plural forms of the term "estimated impulse response" were inconsistent. Applicant respectfully traverses. This rejection is largely similar to the rejection asserted in section 11 of the Office Action, and particularly to the rejection of claim 26. Applicant has amended claim 33 similarly to claim 26 in order to overcome this rejection.

In section 16 of the Office Action, the Office asserted that, in claims 43, 51, and 52, the limitation "said finite impulse response circuit" lacks sufficient antecedent basis. Applicant has corrected these claims by rewriting them to refer to "said finite impulse response filter".

Prior Art Rejections

In section 18 of the Office Action, the Office rejected claims 1, 6, and 11 under 35 U.S.C. § 102(b) as anticipated by Hirano. In fact, Hirano is the primary reference with respect to every prior art rejection contained in the Office Action. The prior art rejections are listed below for ease of reference.

1. Claims 1, 6, and 11 are rejected under 35 U.S.C. § 102(b) as anticipated by Hirano.

2. Claims 18, 26, and 33 are rejected under 35 U.S.C. § 102(a) as obvious over Hirano;

3. Claims 2, 3, 5, 7, 8, 10, 12, 13, 15-17, 19, 20, 22, 25, 27, 28, 30, 31, 34, 35, 37, 39, 40, 42-45, 47, 48, and 50-52 are rejected as obvious over Hirano in view of Mansour & Gray;

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4. Claims 23 and 24 are rejected as obvious over Hirano in view of Mansour & Gray and further in view of Benesty;

5. Claims 38 and 46 are rejected as obvious over Hirano in view of Benesty;

6. Claims 39, 40, 42-45, 47, 48, and 50-52 are rejected as obvious over Hirano in view of Benesty as applied to claims 38 and 46 and further in view of Mansour & Gray.

Applicant respectfully traverses all of the prior art rejections because they are based on a fundamental flaw concerning the teachings of the primary reference, Hirano. In a broad sense, the present inventors have developed a new algorithm for correcting for echo responses in a multi-stereo or other multi-channel environment. Particularly, as far as Applicants are aware, they are the first to develop a <u>frequency domain recursive least squares (RLS)</u> algorithm for a <u>multi-channel environment</u>. Contrary to the Officer's assertion (which will be addressed in more detail below), Hirano does not teach a frequency domain RLS algorithm at all. Also, the Office asserted that Mansour & Gray disclose a frequency domain RLS algorithm even though they do not call it by that name. However, even if Mansour & Gray disclose a frequency domain RLS algorithm, it is for a single channel environment and the difference between a single channel frequency domain RLS algorithm and a multi-channel frequency domain RLS algorithm certainly is not a trivial advancement.

Turning to the specific prior art rejections, all use Hirano as the primary reference and all are based on the assertion that Hirano teaches a frequency domain RLS algorithm. However, this is not true. The Office asserted in section 19 of the Office Action that Hirano discloses a frequency domain RLS algorithm at column 17, lines 41-52. However, Hirano, column 17, line 41-52 are reproduced below.

> As an adaptive algorithm for the adaptive filters. algorithms such as the sequential regression algorithm (SRA) disclosed in B. Widrow et al., "Adaptive Signal Processing",

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(Prentice-Hall, N.J., 1985) or the RLS algorithm disclosed in M. L. Honig et al., "Adaptive Filters", (pp. 145-245, Kluwer Academic Publishers, Hingham, Ma. 02043, U.S.A.) can be employed. Alternatively, an adaptive recursive filter may be employed in place of an adaptive transversal filter. A further option is to use a sub-band adaptive filter or an adaptive filter of a "frequency domain" or "transformed domain."

As can be seen, Hirano essentially discloses six alternative adaptive algorithms. However, none of them are frequency domain RLS algorithms. The Widrow reference discloses neither a frequency domain algorithm nor an RLS algorithm. Rather, it is a time domain SRA (sequential regression algorithm). The Honig reference discloses a time domain technique. The reference to an adaptive recursive filter is generic and certainly does not refer to frequency domain or RLS specifically. Finally, in the last sentence, Hirano mentions three more options, namely, a sub-band adaptive filter, a frequency domain adaptive filter, or a transformed domain adaptive filter. None of these, however, specifically mention frequency domain RLS and, as noted above, Applicant is unaware of any frequency domain RLS technique known in the prior art. Merely, the mention of frequency domain in this last sentence, certainly does not disclose that it is an RLS algorithm. Several frequency domain techniques were known in the prior art. However, none of them were RLS techniques.

Thus, contrary to the Office's assertion, Hirano does not disclose a frequency domain RLS algorithm. Accordingly, all of the prior art rejections necessarily fail since the Office's assertion that Hirano teaches such an algorithm is the fundamental basis of all prior art rejections in the Office Action. All independent claims recite at least that the algorithm is a frequency domain RLS algorithm and, therefore, distinguish over the prior are of record.

Accordingly, Applicant respectfully requests the Office to withdraw all of the prior art rejections.

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In view of the foregoing amendments and remarks, this application is now in condition for allowance. Applicant respectfully requests the Examiner to issue a Notice of Allowance at the earliest possible date. The Examiner is invited to contact Applicant's undersigned counsel by telephone call in order to further the prosecution of this case in any way.

Respectfully submitted,

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